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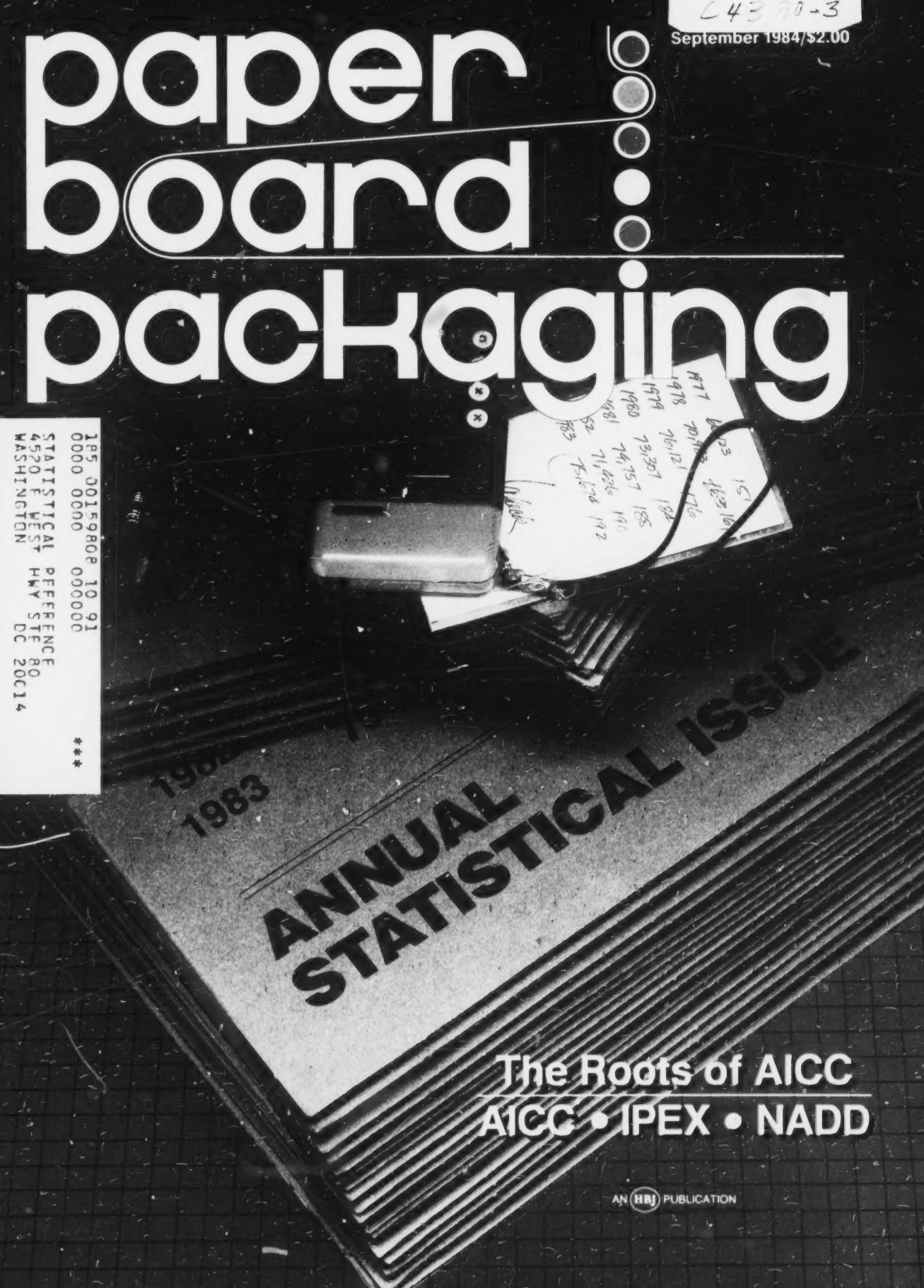

The Roots of AICC

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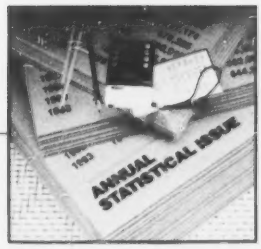
paper board packaging

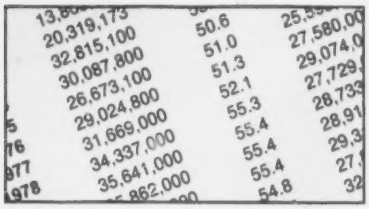
SEPTEMBER 1984, VOLUME 69, No. 8

On the Cover:

Once again, *Paperboard Packaging* presents the most complete single compilation of statistical data on the paperboard industry in its yearly statistics feature. Starts on page 18.



FEATURES



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Now that a Georgia box plant has a nonstop corrugator, its converting equipment must be updated and more space must be added to handle the stepped-up volume of board.

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December: Industry Calendar/Packaging Designing

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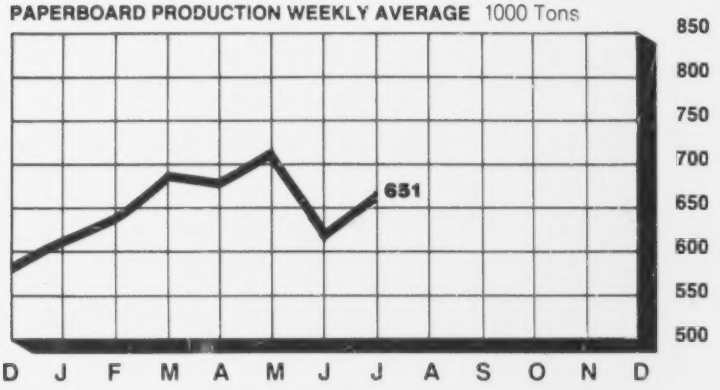
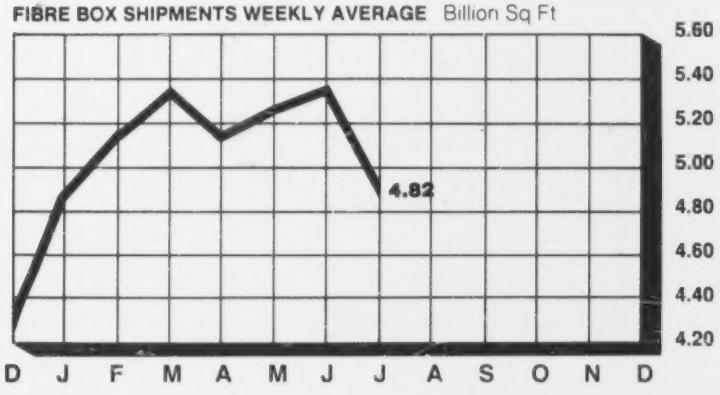
INDUSTRY
STATISTICS FOR 1984

PAPERBOARD PRODUCTION WEEKLY AVERAGE 1000 Tons



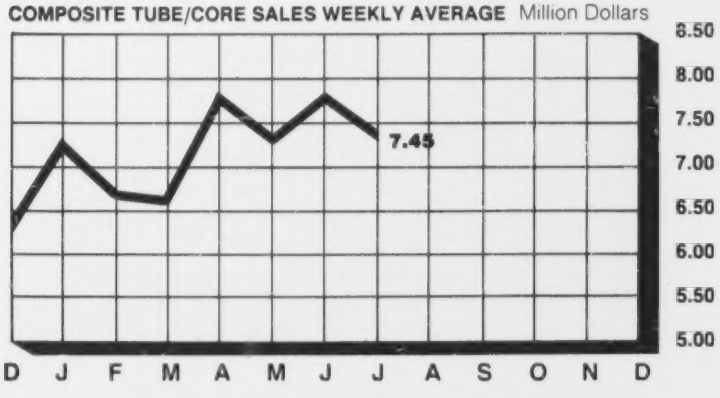
PAPERBOARD MILL OPERATIONS:
The first month of 1984's second half marked a continuation of the upturn in earlier quarters. July's volume of 2871.8 M tons was up 13.6% from the 1983 month, which had been 23% up from the '82 month, which was down 23% from '81, which had been up 8.4% from 1980. Thus, a return to traditional levels of output margin is appearing. This may be due in part to the reduced downtimes for vacations and maintenance, because of improving business. However, production of board varies greatly with region.

FIBRE BOX SHIPMENTS WEEKLY AVERAGE Billion Sq Ft



PAPERBOARD-TYPE PRODUCTION:
In July, 2187.2 M tons of containerboard was up 16.1% from that month of 1983, while 693.6 M tons of boxboards reflected a rise of 7.7%—both as projected from the API's "production by furnish" data. This devastating tonnage ratio of 3-to-1 compares with a traditional 2/1, suggesting that the overall packaging recovery is chiefly one of distance container shipments, rather than small-box business. Thus, the month's boxboards tonnage, though well above recessive periods, was no higher than a half-dozen years ago.

COMPOSITE TUBE/CORE SALES WEEKLY AVERAGE Million Dollars



RIGID PAPER BOXES:
Through July, major set-up boxmakers report a national rise of some 9% in total billings from 1983, compared with 10% in '83 over '82, 8% in '82 from '81, 11% in '81 over '80, and 7% in '80 over '79. Thus, although the annual improvement is steady and consistent, dollar-value in the rigid box market has not kept pace with inflation on a long-term basis. Further, the "point spread" is great, between and among regions, with double-digit improvements in some areas and declines in others; which is why the "mom and pop" shops died out.

paper board packaging INDUSTRY STATISTICS

As each week of containerboard production tops the one before, the industry's contentment is becoming tempered with worries about a possible raw-material-supply shortage from the mills.

How Long Will Good Times Last?

by Fred Sharring
Senior Editor

This business is going at top speed in more directions than I knew there were," said one of the packaging industry's senior managers, addressing a mid-year conference. "I never before heard so many people saying 'I never before saw so much (or so little) thus-and-so at a time when thus-and-so.' "

He could hardly have put it more briefly or more accurately. Economic vigor of the present sort, in any previous experience, would have generated only enthusiasm and encouragement. And yet, in spite of record-setting production rates, under sustained and rising demand, with improving prices and profits, there seems to be an air of some deep unease underlying the operation.

Not many months ago, the question was "When, if ever, will the good times return?" Now, the concern evidently is "How long will they last?"

In truth, the quality and quantity of this current business recovery is downright astounding. Corrugated container demand is one bellwether example. Beginning with the close of last year, fibre box shipments have gone month after month breaking all records for that calendar period. Never before had there been even two such consecutive months. In response to that, containerboard production is also at an all-time high, double-digit percentage points above '83, which had just set a new tonnage record. With minimal exceptions, each successive week of 1984 has exceeded the previous average week—another record, by far.

Just possibly, that gives a clue to this unease in the midst of plenty. The day of undercapacity, and of attrition to under-maintained equipment, may very well be threatening, again.

It's as simple as this: Last year, U.S. mills provided some 32.2 million short tons of packaging boards, as seen in the following Paperboard Mill data section. This year, volume has been running around 10% ahead of that, or about 35.4 million tons to be expected for all of 1984.

But the total mill capacity projected by the American Paper Institute, on basis of existing commitments, is only 35.5 million, and with roughly another 1% increase seen for 1985. Those bare figures entail a machine utilization rate above 100%, entering the second half of this decade—and with almost no new production facilities planned at present.

So, the day of the monster appears to have arrived. In the absence of a miracle, this packaging industry must be faced with near-future stringencies in raw material supply, of a degree and duration that can only be conjectured. And that is more than a mere irritating inconvenience. It is a chaos that opens the way to still further successful competition by non-paper packagings, at a time when the industry most distinctly needs no more.

As one example—this is the year that marked one of paperboard packaging's most dismal setbacks. Major oil producers are shifting from the composite can to the blown plastic bottle for one-quart motor oil packaging. The changeover is based upon valid and responsible market tests, but that end-use has been taking some 36% of the composite cans' total industry output volume. It makes for a sad requiem to so much research and development effort by so many, for so long.

On the other hand, much of the news is good, and even excellent. For many forest products companies, net profits in the year's first half were double and triple those of same-period 1983. The prices of materials and converted products have been improving steadily. (A wry note in that regard is that the kraft linerboard price "sat" unchanged for a decade, between 1963 and '73. In the 10-odd years since then, there have been 18 changes for the same material!)

Above all—the U.S. citizen continues his love affair with packaging. The average American spent an average total of $83 for it last year—up 80% in the decade—to bring home his exotic comforts from the far places.

This is not the first time that his packaging industry has entered a new, and in many ways disturbing, setting of scene. In all likelihood, another 10 years will find him paying yet another 80% for its services, and more than happy with the opportunity.

Paperboard in the General Economy

Table A-1: Total U.S. production of paper plus paperboard in 1983 would appear to be below the tonnage of some previous years, and indeed the paperboard volume shown is below that of recessive 1982, and even of 1973. However, as footnoted, those previous years' data were compiled by federal agencies, among others, and include certain non-packaging boards not included in American Paper Institute summaries. These reports are no longer developed by federal agencies. Accordingly, in this and future years, the board tonnage shown will reflect packaging-

related materials, as recognized by the API.

Table A-2: A 550.6-lb share of the country's paper and board output accrued to each of its citizens in 1983—approximately nine times the portion of the average citizen elsewhere in the world, including those of the more industrialized countries.

However, these 1983 totals suggest that U.S. per-capita paperboard use, in a relatively vigorous year, was below that of most years in the decade. To complete the anomaly—paper grades' consumption is shown at a record level.

This contradiction arises from three major factors. One is the elimination of those non-packaging boards previously included in now-discontinued government reports. Another is the significant takeover of some paperboard applications by alternate packaging materials.

A third factor is the tremendous increase in paper-grades consumption, with the rocketing proliferation of the data processing/reporting area, and the sudden and welcome resurgence of printed publications in many field.

Table A-3: In each average day of 1983, the average U.S. citizen accounted for nearly three paperboard containers of the basic types listed—more than 1000 per person during the year. And that does not include an estimated 32 billion milk cartons, about 150 per year, along with the various other specialties that bring individual use much higher.

However, a wide variation is visible in the long-term demand for these basic package types. Thus, across 20 years, the national daily consumption of fibre boxes is up 115%, while that of folding cartons rose only 18% and rigid paper set-up box units actually dropped 12%. With an increase of nearly 200% for the grand champion—composite cans/tubes—the national total of those listed went up 33% in the double-decade.

Table A-4: One of the rarest events in packaging industry history is a decrease, from any previous year, in the total annual value of converted paperboard products. Yet the 1983 record is such an occasion—down slightly

A-1 — Board & Tonnage Relatinship (tons)

Year	Paperboard	%	Paper	%	Total Paperboard and Paper	%
1943	8,620,400	50.6	8,415,300	49.4	17,035,700	100.0
1953	13,865,300	52.1	12,739,300	47.9	26,604,600	100.0
1963	20,319,173	52.1	18,692,587	47.9	39,011,750	100.0
1973	32,815,100	53.1	29,014,900	46.9	61,830,000	100.0
1974	30,067,800	50.6	29,421,100	49.4	59,508,900	100.0
1975	26,673,100	51.0	25,595,900	49.0	52,269,000	100.0
1976	29,024,800	51.3	27,580,000	48.7	56,604,800	100.0
1977	31,669,000	52.1	29,074,000	47.9	60,743,000	100.0
1978	34,337,000	55.3	27,729,000	44.7	62,066,000	100.0
1979	35,641,000	55.4	28,733,000	44.6	64,374,000	100.0
1980	35,862,000	55.4	28,912,000	44.6	64,774,000	100.0
1981	36,364,000	55.4	29,317,000	44.6	65,681,000	100.0
1982	33,842,000	54.8	27,888,000	45.2	61,730,000	100.0
1983	32,176,700	49.4	32,962,200	50.6	65,138,900	100.0

Source: Through 1982, Bureau of Census and U.S. Pulp Producers Assn. Paperboard tons exceed classification of American Paper Institute in Paperboard Section of this issue through inclusion of certain boards not classified in institute figures.API thereafter.

A-2 — Per Capita Production, Paperboard & Paper (pounds)

Year	U.S. Population	Paperboard	Paper	Total Paperboard & Paper
1943	136,485,262	126.3	123.3	249.6
1953	159,636,000	173.7	159.6	333.3
1963	188,616,000	215.5	198.2	413.7
1973	210,404,000	311.9	275.8	587.7
1974	211,090,000	284.0	277.7	561.7
1975	213,641,000	249.7	239.6	489.3
1976	214,659,000	270.4	257.0	527.4
1977	216,383,000	292.8	268.8	561.6
1978	218,228,000	314.7	254.1	568.8
1979	220,099,000	323.9	261.1	585.0
1980	223,174,000	321.4	259.1	580.5
1981	226,292,000	321.4	259.1	580.5
1982	230,547,000	293.6	242.0	535.5
1983	233,662,000	272.0	278.6	550.6

Source: Based on Table A-1 and mid-year population estimate of Bureau of Census

from banner-year '81, though up 103% from 1973, and 330% higher than two decades ago.

Product-value advances, respectively for the year and the decade, are: fibre boxes 5.4/102%, folding cartons 0.8/38%, set-up boxes 10.1/68%, and all other converted board products 15.6/104%.

Among victims of political and legal evolutions is the computation of value-added, from raw materials to converted products. Pricing information is no longer discussed by industry associations or compiled by the government.

Wood Pulp

Table B-1: U.S. domestic pulp production reached an all-time high tonnage in 1983, up 14% from 10 years ago and 83% in 20 years. Imports were up a full 22% from '82, with the expansion in U.S. paper/board demand—more than seven times the average rise over 10 years.

Pulp exports also exceeded all previous years, by a wide margin, up 22% from 1982, or nearly three times the decade's average annual increase.

That, unfortunately, reflects the relatively doleful economic scene in many overseas areas, where costs of raw materials and processing are far above those we find oppressing. In some non-oil-producing nations, across both oceans, the expenses of operation are so

continued on page 22

A-3 — Principal Paperboard Packages Used, Per Day & Per Year*

M containers used per day

Year	Corrugated & Solid Fibre	Folding	Set-up	Cans & Tubes	Drums	Total Per Day	M. Containers Total Per Year
1943	12,360	163,000	17,980	5,360	26	198,726	72,525,000
1953	22,800	268,000	20,500	15,900	75	327,275	130,946,300
1963	35,222	410,000	15,284	23,900	88	484,500	176,842,500
1973	65,888	489,839	16,580	53,346	145	625,798	228,416,300
1974	62,427	482,337	14,689	56,360	153	615,966	224,829,700
1975	56,175	448,574	11,082	53,451	130	570,582	207,930,300
1976	62,972	488,496	12,088	59,705	151	623,392	227,694,000
1977	66,123	497,350	13,070	64,303	163	641,009	233,968,000
1978	70,983	515,254	14,168	66,993	176	667,174	243,685,300
1979	76,121	517,892	15,058	69,070	184	678,325	247,758,200
1980	73,307	505,453	14,671	67,296	188	660,915	241,234,000
1981	74,757	499,799	14,337	67,824	190	656,907	239,771,000
1982	71,426	491,318	13,584	66,234	192	652,907	238,292,000
1983	75,674	484,442	13,394	70,664	199	644,373	235,196,000
1983 Per Capita Use	0.328	2.067	0.050	0.306	0.0008	2.752	1.005

*Exclusive of certain sanitary containers.

A-4 — Value of Principal Converted Paperboard Products Shipments

Year	Fibre Boxes	Folding Cartons	Rigid Boxes	Other Converted Board Products	Grand Total
1943	$492,068,100	240,830,000	104,700,000	194,600,000	1,032,216,000
1953	1,315,190,400	764,866,300	240,000,000	583,800,000	2,903,876,700
1963	2,065,659,200	959,800,000	247,307,000	1,208,800,000	4,484,205,900
1973	4,862,056,300	1,460,000,000	484,950,000	2,751,281,000	9,558,287,300
1974	5,792,984,900	1,694,980,000	536,900,000	3,246,641,000	11,271,505,900
1975	5,623,765,200	1,755,000,000	483,155,000	3,361,600,000	11,223,520,200
1976	6,443,938,300	1,979,000,000	556,111,000	3,865,840,000	12,844,889,300
1977	6,741,744,100	2,105,000,000	602,268,300	4,114,413,000	13,563,425,400
1978	7,260,097,300	2,278,000,000	652,968,100	4,439,452,000	14,631,406,200
1979	8,407,894,000	2,435,000,000	707,878,000	4,899,699,000	16,450,471,000
1980	9,075,381,800	2,620,000,000	738,317,000	5,274,226,000	17,707,924,800
1981	10,019,521,200	2,866,000,000	787,800,000	5,801,059,000	19,474,380,200
1982	9,343,619,900	2,952,000,000	739,419,000	4,843,869,000	17,878,890,800
1983	9,845,258,200	2,976,000,000	814,100,000	5,600,891,000	19,342,249,300

Sources: Fibre Boxes, Fibre Box Assn.; Folding Cartons, Paperboard Packaging Council; Set-up Boxes, Natl. Paperbox & Packaging Assn; Other, including cans, tubes, drums, sanitary containers, and die-cut paperboard, from Annual Survey of Mfrs.

B-1 Total U.S. Pulp Production, Net Supply & Comsumption (M short tons)

Period	U.S. Produced	Imported	Exported	Net New Supply	Consumed in Board and Paper	Non-Paper Uses
1953	17,537	2,158	162	19,533	18,684	799
1963	30,121	2,775	1,422	31,475	30,220	1,034
1973	48,355	3,993	2,344	50,004	48,862	1,146
1975	40,583	3,078	2,565	41,096	42,620	783
1977	46,858	3,864	2,640	48,082	46,704	1,097
1979	53,225	4,382	2,791	54,816	53,057	1,222
1980	53,319	4,026	3,806	53,539	52,321	1,166
1981	54,362	3,804	3,677	54,489	53,054	1,137
1982	52,443	4,289	3,547	53,185	51,784	1,110
1983	54,905	5,233	4,328	55,810	54,215	1,134

Source: American Paper Institute.

high for some products that they can be imported from the U.S., including freight, at significantly lower cost than they can be produced at home from native or imported raw materials. However, as seen in Table B-2, the volumes of both exports and imports vary greatly with the grade of pulp concerned.

Table B-2: As usual, the U.S. output of bleached kraft pulp reached a new all-time high last year, and—also as usual—its export volume exceeded that of all other pulp grades combined. This popularity goes on and on, despite a price increase of 143% over 10 years, as seen in Table B-3.

A measure of the bleached-pulp proliferation is this: In 1973, net supply of bleached plus unbleached kraft pulp was recorded by federal agencies as 32.573 million short tons, of which the bleached material represented 44%. By 1983, the combined net supply had gone up 45%, to 45.292 million tons. But of that additional new tonnage in the decade, 65% was in bleached pulp, which thus represented more than half of the 1983 net supply—in competition with the unbleached pulp, basic material for the nation's vast production of kraft linerboards.

A sad development to be seen here is the decline in virgin bleached sulfite tonnage—down 25% in 1983 net supply from a decade ago, and by 40% in 20 years. This is in part because of replacement by sulfates in some applications, and in part through replacement, at relatively low cost, by recycled pulps.

Table B-3: The sudden impact of the early-1970s escalation in world petroleum prices is nowhere better illustrated than in pulp price trends, as the costs of production soar.

For example, between 1953 and '63 the prevailing ton-price for unbleached kraft pulp rose a sedate $21.18 or 22%, and that of bleached kraft actually droped 2%. Between '63 and '73 the price for unbleached went up a modest 52% and for bleached rose 38%. Then came OPEC! In the years between mid-'73 and mid-'84 (these are mid-year prices) the cost of unbleached kraft pulp shot up by 137%, and of bleached by 143%.

From another view: In the 10-

odd years since 1973 (when the Arab oil price erupted), the price of bleached kraft pulp—especially vulnerable to chemical costs—rose by six times more than it had in the 20 years preceding 1973. In another aspect: The price of bleached kraft pulp has increased 275% in the past 30 years, and more than four-fifths

B-2—U.S. Pulp Production, Net, Supply by Principal Paper Grades (M short tons)

	UNBLEACHED KRAFT				BLEACHED KRAFT				SEMIBLEACHED KRAFT			
Year	Imported	Domestic	Exported	Net Supply	Imported	Domestic	Exported	Net Supply	Imported	Domestic	Exported	Net Supply
1953	293	6,753	29	7,107	590	2,692	134	3,269	242	878	75	1,045
1963	223	10,502	149	10,581	1,282	7,439	501	8,220	525	2,427	304	2,748
1973	368	17,580	71	17,877	2,500	13,228	1,032	14,696	189	1,826	80	1,744
1975	190	15,227	96	15,301	2,132	12,756	1,379	13,509	104	1,375	87	1,384
1977	245	18,399	104	18,540	2,588	14,887	1,369	16,106	138	1,538	89	1,587
1979	258	19,391	199	19,450	2,935	17,987	1,908	19,014	137	1,651	97	1,691
1980	263	19,942	202	20,002	3,355	18,990	2,014	20,331	128	1,704	99	1,733
1981	305	21,133	215	21,223	3,611	20,008	2,048	21,571	119	1,816	96	1,839
1982	283	19,617	199	19,701	3,559	19,722	2,019	21,262	110	1,686	89	1,707

	UNBLEACHED SULFITE				BLEACHED SULFITE				SEMICHEMICAL		
Year	Imported	Domestic	Exported	Net Supply	Imported	Domestic	Exported	Net Supply	Domestic	Exported	Net Supply
1953	380	594	31	944	589	2,406	87	2,908	1,198	n.a.	1,198
1963	128	510	57	581	508	2,180	194	2,494	2,621	n.a.	2,621
1973	147	373	5	515	356	1,920	293	1,983	4,009	5	4,004
1975	60	366	23	403	299	1,659	246	1,712	3,419	9	3,410
1977	57	413	8	462	454	1,656	192	1,918	5,327	4	5,323
1979	39	287	7	319	396	1,248	145	1,499	6,812	12	6,800
1980	32	365	7	390	372	1,449	137	1,684	7,946	14	7,932
1981	29	249	7	371	337	1,389	122	1,604	8,401	15	8,416
1982	33	394	8	419	304	1,254	110	1,448	7,920	14	7,906
1983	37	410	6	491	441	1,261	97	1,477	6,113	7	6,106

Source: Bureau of Census, U.S. Department of Commerce, American Paper Institute

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B-3—Average Yearly North American Pulp Prices (Per Short Ton)

Year	Unbleached Kraft	Bleached Softwood Kraft	Unbleached Sulphite	Bleached Sulphite	Ground-wood
1953	$ 96.77	$142.58	$123.18	$146.10	$ 74.56
1963	117.95	139.10	118.77	133.35	87.50
1973	180.00	192.00	170.00	187.00	102.00
1975	335.00	353.00	335.00	354.00	200.00
1977	335.00	365.00	335.00	354.00	200.00
1979	365.00	400.00	375.00	400.00	240.00
1980	395.00	432.00	380.00	420.00	245.00
1981	425.00	465.00	385.00	440.00	250.00
1982	440.00	470.00	430.00	440.00	250.00
1983	372.00	408.00	354.00	395.00	250.00
1984 1st half	426.00	467.00	400.00	480.00	260.00

Represents announced contract levels—not necissarily the actual selling price

of that rise has appeared in the latest 10 years.

Paperstock

Table C-1: In 1983, total recovery volume of secondary fibre reached a record tonnage for any year, which sounds uplifting until it is noted that, over the past two decades of our greatest economic expansion, the tonnage of U.S. paper/board consumed went up 75%, but only one-fifth of the added material appeared as a reclaimed-fibre increase.

One strongly encouraging trend, as for many other basic commodities, is that of export demand, which last year produced record-high overseas shipments. Indeed, trends of the past half-dozen years suggest that export, to both industrialized and developing countries, may provide a future outlet for our reclaimed fibres that is beyond any present prediction.

Table C-2: Although the percentage of secondary fibre entering into the 1983 U.S. production of paper and board was at its highest level of this decade, it remains a far cry from that in the early years of this economic expansion, three decades ago. If the paper stock ratio in '83 had merely equalled that of '53, an additional 4 million tons of reclaimed fibre would have been taken.

In short, a highly limited effect has been generated by the widely publicized recent-years' appeal for greater resource recovery, and by the intensive research into utilization of non-wood fibres.

It appears that, as in the case of our gas and petroleum supplies, we will not turn to alternate materials until there is no choice.

Table C-3: These price ranges show the highs and lows, in the 18 months ending mid-1984, for basic paper stock grades in representative areas, as reported to *Official Board Markets* by mills and dealers.

A notable and probably irreversible trend in the secondary fibre field is the slow fading of marked

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demand, and thus of price, for such formerly high-volume grades as Mixed Paper, as compared with the high and rising price of the high-grade pulp substitutes. The reason for both shifts is: processing cost.

The recent years' explosion in cost of energy, labor, credit, and transport has elevated processing cost beyond the end-use value of those low-grade fibres.

On the other hand, prices for the better qualities of generator scrap, such as require little or no processing before pulping, have gone in quantum multiples.

For example, 10 years ago the typical mid-continent price for the Mixed Papers grade was about what it is now—despite all inflation—with an $80 range-average for Hard White Shavings. Today, the Shavings prices has more than tripled, because of their ability to directly replace costly virgin pulps, in some cases.

This disparity can only widen, as processing costs increase over the years, along with an expanding supply of good-quality one-use white papers generated in data-processing usages.

Paperboard Mills

Table D-1: Total U.S. production of packaging paperboards in 1983 was at an all-time high, 10.7% above the tonnage of recessed 1982, 2.4% above the previous record of 1979, and 8.7% ahead of 10 years ago. As to the latter increase—it must be noted that the tonnage

C-1—Paper Stock Recovery vs. board/Paper Consumption (M tons)

Year	Board and Paper Consumption	Mill Paperstock Receipts	Total Recovered	Mill Consumption	Imports	Exports	Paperstock Recovery Ratio
1953	31,434	8,427	8,498	8,366	60	114	26.8
1963	43,406	9,655	9,551	9,585	55	230	22.2
1973	67,337	12,264	12,947	12,374	87	683	19.2
1975	55,907	10,228	10,904	10,345	72	861	19.5
1977	65,226	10,279	10,959	11,071	148	1,544	16.8
1979	69,929	12,985	14,245	12,871	170	2,139	20.4
1980	68,564	12,712	15,429	12,620	164	2,717	22.5
1981	69,867	13,480	15,693	13,382	137	2,213	22.5
1982	65,364	12,670	14,797	12,578	135	2,217	22.5
1983	70,566	15,674	18,623	15,560	143	2,619	23.2

Source: American Paper Institute, National Assn. of Recycling Industries

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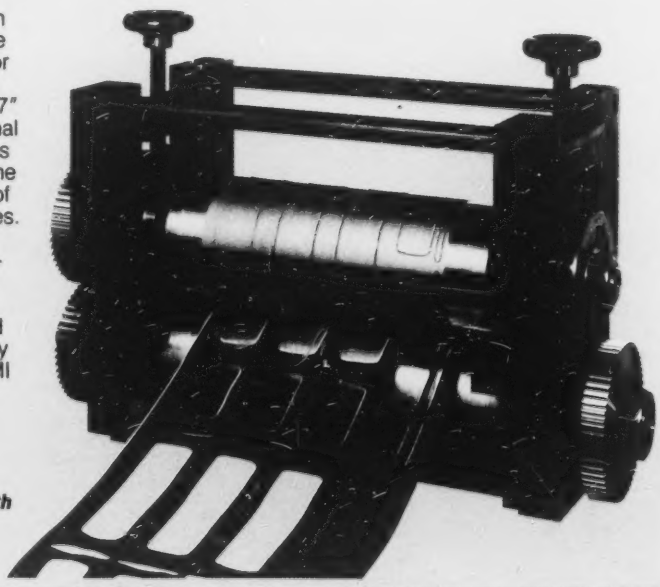

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expansion was 59% between 1963 and '73, and 48% between '53 and '63.

Continuing in 1983 is the growth of recycled corrugating medium which had been eclipsed for many years by virgin furnishes. This is in part because of the need for conserving limited primary-kraft capacity, but also because of the greatly improved technologies for preserving high-quality characteristics during recycling.

Worthy of some note is that the 1983 tonnage of packaging boxboards is actually below that of 10 years ago—with a drop of 1% in folding boxboard, 45% in set-up board, and 15% in milk/food boards. This is a measure of the extent to which alternate materials have taken over applications previously served by paperboard packagings.

On the other hand, this lost tonnage and more reappears in the "other" board category, not identified as box material, but forming components in the shrink- and stretch-packs, the composite cans, and other innovations. Thus, the combined tonnage of these "identified" boxboards plus the "other" boards is up, over the decade.

Table D-2: The 1983 mill activity ratio—simple proportion of actual production of projected capacity—was again at traditional level, following the paralysis of 1982. However, this year finds production hovering around 10% above 1983, with no corresponding increase in scheduled capacity.

A similar encroachment occurred in vigorous 1973, with some unfortunate results in postponed maintenance of major machinery and equipment.

At that time, the nation at least had a fairly substantial influx of new capacity about to go on stream. That is not the case now, and in the absence of an economic downturn, the near future may develop sharp shortages in some paperboard grades.

Table D-3: U.S. capacity for packaging paperboard, on basis of existing construction commitments, will expand by a scant 1% between 1984 and '85, comprising a 1.1% advance in containerboard grades and 0.8% for boxboard types.

That is unrecognizeably below the typical average annual advance of earlier years. It is, in fact, the smallest yearly increase in U.S. paper industry history, and is an indicator of the recent years' forced revisions in spending plans.

Basic costs of mill construction have much more than tripled in this single decade, vastly exceeding the improvements in sale price of mill output, or of the converted packaging products. The only near-parallel is the similar escalation of energy prices in these 10 years.

A similar "quantum" advance in paperboard packaging prices is only inevitable, before it again becomes economic to expand the capacity for producing them. But now, here come the years of "agonized readjustment."

Corrugated & Solid Fibre

Table E-1: U.S. box plant production of corrugated plus solid fibre materials in 1983 (without deduction for converting scrap) was the highest in history, 7.3% above recessed 1982, and 1.2% ahead of the previous high in '79, up 11.5% in

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C-2—Ratio of Paperstock to Total Fibrous Materials Consumed in Board & Paper Production (M short tons)

Year	Woodpulp	Paper Stock	Other Materials*	Total	Paper Stock Percent of Total
1953	19,644	8,294	961	28,899	28.7
1963	31,475	9,551	1,285	41,056	23.2
1973	48,889	12,374	883	62,156	20.0
1975	42,620	10,345	587	53,552	19.3
1977	46,704	11,071	627	58,402	19.0
1979	53,057	12,871	723	66,651	19.3
1980	53,321	12,620	588	66,529	19.0
1981	53,054	13,382	1,056	67,492	19.8
1982	51,784	12,578	622	64,984	19.4
1983	54,215	15,560	719	70,494	22.1

Source: API, NARI

*Linter pulp, straw bagasse, etc

the decade, 99.4% in 20 years, and 216% in 30 years.

It appears that fibre boxes are reaching some saturation point in the shipping container market, as alternate packaging forms remain unable to compete in most uses.

Thus, in the postwar decade of 1953-63, average annual increase was 5.8%; between 1963 and '73 it rose to a 7.9% annual average, as the takeover advanced. But in the latest decade, annual expansion has settled to a 1.6%, more in keeping with national growth rate.

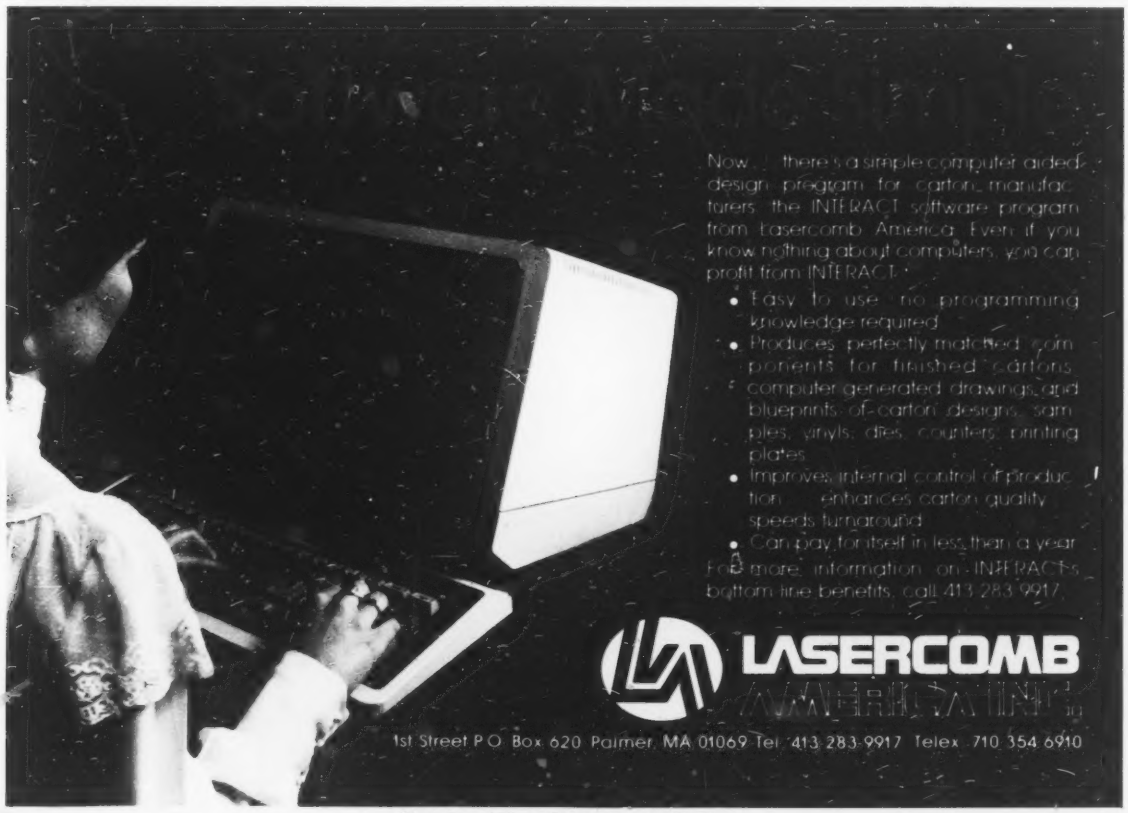
Another indicator of this is the pattern in recent years of annual advance and retreat, sensitive to the economic cycles. This depicts a basically mature industry, unlikely to develop any further major expansions or contractions, but responsive to the regular temporary valleys and peaks of the overall economy.

One more evidence of a present maturity, and also of container diversification, appears in the average weight of corrugated board per unit area. Thus, in 1953, 1 ton of containerboard produced 14,044 sq ft of converted board. In 1963, and again in '73, the footage had gone up to 14,600 sq ft per ton, as kraft and semichemical replaced the dwindling use of older, heavier board types. But in 1983, footage had dropped to 14,360 sq ft per ton—reflecting the rapid increase in production of double- and triple-wall corrugated.

Table E-2: U.S. shipped footage of corrugated plus solid fibre products in 1983 was the highest of all time, up 7.4% from '82 and 10.7% from '73—the latter year was a then-record. Total value of shipments reached only a second-best, however, down 1.7% from the 1981 record, though 5.4% up from recessive 1982.

The 11% increase in shipped corrugated footage over the 1973-83 decade is only one-ninth of the increase in average-foot value. This value advance is largely in response to the escalation of energy cost that began 10 years ago, and has provided the industry with a cushion against the inflation rate.

Footage of solid-fibre products is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now only 0.4% of all shipments, roughly one-third of the proportion in 1963 and one-tenth of that in '53. However, while the footage of solid fibre has dropped some 60% over 30 years, the decline in value has been nil! It's clear that the solid fibre materials have some applications in which they are not readily replaced. An example is the popular reusable slip-sheet for separating stacks of blanks and converted products on skids.

The expansion of U.S. per-capita box consumption, compared with the rise in population, illustrates the importance and acceptance of these protective containers in our national economy and lifestyle.

In the 1973-83 decade, individual box demand went up 18%, while the population rose 11%. Since 1963, we have 24% more people, and 77% more boxes for each. And, over the 30 years since 1953, per-capita share of shipping containers has increased three times as fast as the number of persons—47% more people, and 149% more boxes per person.

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That, in turn, reflects the vastly improved standards and style of life made possible by the dependable protection and preservation of consumer products over long-distance shipment. In cheery acceptance of this, the average U.S. citizen spent $42.13 for his 1983 share of fibre containers. The individual expenditure had been $23.11 in 1973—$10.95 in '63, and $8.24 in '53.

This four-fold expansion of personal expenditure, over 20 years, counteracts the decline in birth rate of new customers—a trend that has been of considerable concern to market planners.

Thus, between 1953 and '63 the average annual U.S. population increase was 1.8%—half-again the reduced rate of 1.2% between '63 and '73, and not far from double the 1% annual rise in this latest decade. However, as noted, the average citizen's spending for his fibre box share went up five-fold in those 30 years. This compensates not only for the decrease in population rate but for the drop in dollar value.

Table E-3: Developments in super-high-strength corrugated packagings are reflected in the expansion of double- and triple-wall board, compared with standard double-face. These heavy-duty materials comprised 8.6% of the 1983 production (before box conversion) compared with 5.5% in 1953, but their proportion of the footage added over those three decades has been 10% of the total.

Thus, while the double-face share in 1983 remained at 91% of total production, and was up 11% since '73 and 96% since '63 and 211% since '53—output of the heavy-duty boards rose 12% from '73 and 174% from '63, and 393% from 1953.

Production of flexible single-face corrugated continues to remain remarkably stable, over the years, in view of its chief application as a protective wrapper, and that in competition with novel new cushionings such as foamed plastic nodules. It appears that single-face, like the solid-fibre boards, fills some functions in which it is not readily replaced, while at the same time it has little latitude for new uses.

Table E-4: The extent to which non-kraft containerboards have been supplanted by the primary materials is readily seen in this

summary. In 1953, about 20% of all boards entering into U.S. corrugated/solid fibre production comprised the chestnut, jute, straw, and other venerable grades of yesteryear. By 1963 the proportion had dropped to 2%, and in 1983 was a mere 0.2% of total.

With this fade-out of the bulkier boards, total footage produced in 1983 was up 98% from '63 and 209% from '53, while board tonnage consumed went up only 91% and 194%, respectively—a measure of the adoption of lighter kraft.

However, a distinct reversal may be nearing in that abandonment of non-kraft board production. Once again, that point is appearing in the historic cycle at which the existing kraft mill capacity is hard-put to meet demand. But little construction is currently under way, because of exorbitant building costs of terms of present product prices. Until these factors make their cyclic readjustment, it is almost inevitable that the available non-kraft capacity, now idle or under-scheduled, will become due for another reactivation.

Table E-5: Between mid-1983 and mid-'84, for the fifth consecutive year, a drop appeared in the number of operating U.S. corrugated combiner plants, sheet plants, and total companies, according to listings in our *Official Container Directory*.

Since the heyday years of 1978-79, the industry's staff of converting facilities has been reduced by 140 units, including 42 combiner and 98 sheet plants, with 88 operating companies gone from the scene.

C-3 — Domestic Paperstock Price Ranges Per Ton — 1983-1984

Based on transactions during 1983 and Jan.-June 1984
For current prices see Official Board Markets
Mill prices F.O.B. cars or trucks. All prices in bales — bales 500 lb. min.

	New York	Chicago	Southeast
No. 1 Mixed Paper	$5-15	$7.50-25	$5-20
No. 1 Baled News	35-40	35-55	30-40
Old Corrugated Boxes	45-55	25-60	25-70
Boxboard Clippings	20-25	20-50	20-30
White Ledger	60-65	60-80	55-65
	East	**Midwest**	**Southeast**
Dbl. Lnd. Kraft Corr. Clips	$47.50-82.50	$47.50-82.50	$50-85
Hard White Shavings	180-270	180-270	180-270
Man. Tab. Cards	220-260	220-260	220-260
White News Blanks	65-140	65-140	65-140

D-1 — Paperboard Mill Production by Grades (tons)

Grades	1953	1963	1973	1979	1982	1983
Other (Jute) Liner	827,200	707,400	289,100	402,300	279,000	289,100
Kraft Liner	3,382,000	5,701,000	11,066,800	12,417,300	11,656,500	12,835,600
.009 Semichemical	1,255,700	2,287,100	4,126,500	4,573,600	4,202,500	4,532,700
Recycled Medium	640,800	674,700	1,128,500	1,202,300	1,139,500	1,305,400
Chip & Filler	334,700	262,500	317,100	229,300	230,200	210,200
Total Containerb'd	**6,440,400**	**9,633,200**	**16,928,000**	**18,824,800**	**17,507,500**	**19,173,000**
Folding Boxboard	2,382,500	3,217,200	4,704,500	4,724,700	4,333,700	4,646,000
Set-up Boxboard	680,300	523,200	465,300	306,000	223,600	256,300
Milk/Food Board	963,800	1,680,300	1,594,500	1,443,900	1,283,700	1,358,800
Total Boxboard	**4,026,600**	**5,420,700**	**6,764,300**	**6,474,600**	**5,841,000**	**6,621,100**
Other	2,077,200	3,541,600	5,911,000	6,129,600	5,716,800	6,742,600
Grand Total	**12,544,200**	**18,595,500**	**29,603,300**	**31,428,900**	**29,065,300**	**32,176,700**

D-2 — Board Mill Capacity & Utilization (tons)

Year	Capacity—American Paper Inst.	Utilized (Production)	Activity Rate	Unused—Excess Capacity
1953	13,488,400	12,544,200	93	944,200
1963	19,785,800	18,598,700	94	1,187,100
1973	30,543,000	29,603,300	97	939,700
1975	32,951,000	24,717,300	75	8,237,700
1976	32,338,000	28,439,100	88	3,899,000
1977	32,568,000	28,953,100	89	3,974,900
1978	33,332,000	30,274,900	91	3,024,200
1979	33,559,000	31,428,900	93	2,130,100
1980	33,788,000	30,952,300	92	2,835,700
1981	34,245,000	31,232,200	91	3,012,800
1982	35,501,000	29,065,300	82	6,435,700
1983	35,131,000	32,176,700	92	2,954,300

Source: American Paper Institute. Capacity is obtained by dividing production by activity rate (X100).

However, the remarkable advance in productivity per-plant continues, through development and installation of markedly more effective equipment. In 1954, the average U.S. corrugated combiner plant produced 244 million sq ft of board (before conversion). That average reached 286 million in 1964, and 363 million in '74, and a dependably estimated 468 million

continued on page 36

For more information on International Paper Box Machine Co., Circle No. 101 on Reader Inquiry Card →

in 1984. Thus, average combiner plant output has gone up 29% in this decade, and 64% over 20 years, and 92% in 30 years.

Folding Cartons

Table F-1: Folding carton production tonnage in 1983 was up 1.4% from recessive '82, though 3.8% down from the record high of 1979, and only 1.1% above the level of 10 years ago. In fact, the '83 shipments tonnage was only 12.4% higher than that of 20 years ago, and 17.5% up in 30 years.

However, this rough tonnage comparison does not take into account the recent-years replacement of some heavier cartonboards by the newer, stronger, lightweight materials offering greater area per ton. The extent of this replacement may be assessed from the sequences in Table E-2.

In further compensation, the '83 average-ton value, which exceeded the $1000 mark for the first time in 1981, was up 4% from that historic year, and by 101% in 10 years, by 176% from 1963, and by 189% from '53. The total value of expanded folding carton shipments is, therefore, due chiefly to higher

D-3 — Future Board Capacity, Existing Commitments

(313-day basis, at year end, M tons)

	1982	1983	1984	1985
Kraft Linerboard	16,032	16,266	16,390	16,670
Comb. Linerboard (Jute)	379	459	459	459
Semichemical Medium	5,207	5,156	5,218	5,240
Other Medium	1,423	1,469	1,492	1,496
Container Chip	334	315	317	317
Total Containerboards	**23,375**	**23,665**	**23,916**	**24,182**
Bending Board	5,524	5,495	5,550	5,586
Non-Bending Board	331	333	335	336
Bleached Linerboard	104	104	111	109
Other Bleached Packaging	1,812	1,758	1,799	1,827
Other Bleached	219	217	221	222
Total Boxboards	**7,990**	**7,907**	**8,016**	**8,080**
Wallboard Facing	1,255	1,220	1,228	1,228
All Other Board	2,298	2,339	2,353	2,364
	3,553	3,559	3,581	3,592
Total Paperboard	**34,918**	**35,131**	**35,513**	**35,854**

Source: American Paper Institute

E-1 — Annual Fibre Box Plant Production (tons & M sq ft)

	Corrugated		Solid Fibre		Total	
Year	Tons	M Sq Ft	Tons	M Sq Ft	Tons	M Sq Ft
1953	5,954,200	83,618,000	353,000	2,235,200	6,307,200	85,853,300
1963	9,102,200	132,510,100	170,900	1,123,400	9,273,100	133,633,500
1973	16,284,500	236,918,900	161,900	1,139,300	16,446,400	238,058,200
1974	15,284,300	224,534,200	144,500	1,016,700	15,428,800	225,550,900
1975	13,860,800	203,230,200	114,600	806,600	13,975,400	204,036,800
1976	15,667,100	227,817,700	122,200	859,800	15,667,100	228,677,500
1977	16,337,200	238,800,900	126,900	893,100	16,464,100	239,694,000
1978	17,541,250	256,400,900	131,100	922,400	17,708,700	257,323,300
1979	18,159,700	261,072,000	137,400	966,600	18,159,700	270,738,000
1980	17,489,500	251,939,000	129,400	910,200	17,618,900	252,849,200
1981	17,821,200	253,032,000	119,800	842,500	17,941,000	253,874,500
1982	17,717,900	246,298,000	128,300	902,000	17,846,200	247,191,000
1983	17,717,900	246,298,000	128,300	902,000	17,846,200	247,191,000

Source: Fibre Box Assn. Production is at end of combiner, without deduction of box shop waste. Tons represent board consumed

E-2 — Corrugated & Solid Fibre Shipments (M sq ft & value)

	Total M Sq Ft			Total Value			Per Capita Shipments	
Year	Corrugated	Solid Fibre	Total	Corrugated	Solid Fibre	Total	Mid year U.S. Population	Sq Ft Total
1953	81,154,500	2,151,700	83,306,200	$1,247,478,400	$67,712,000	$1,315,190,400	159,636,000	521.9
1963	127,471,800	1,116,000	128,587,800	2,025,591,400	40,067,800	2,065,659,200	188,616,000	681.4
1973	226,984,300	1,067,900	228,052,200	4,815,486,600	46,569,700	4,862,056,300	210,404,000	1014.8
1974	215,119,000	953,000	216,072,000	5,742,301,300	50,683,600	5,792,984,900	211,909,000	1019.6
1975	193,573,100	756,100	194,329,200	5,578,612,500	45,152,700	5,623,765,200	213,641,000	909.6
1976	215,564,600	806,600	216,371,200	6,395,870,800	48,067,500	6,443,938,300	214,659,000	1008.0
1977	226,359,700	837,800	227,975,000	6,691,170,000	50,574,100	6,741,744,100	216,383,000	1050.0
1978	242,998,100	898,900	243,898,000	7,204,311,000	55,786,300	7,260,097,300	218,228,000	1115.5
1979	249,701,000	942,000	250,643,000	8,344,624,600	63,269,400	8,407,984,000	220,099,000	1138.8
1980	240,490,000	888,000	241,277,000	9,010,411,600	64,970,200	0,075,381,800	223,174,000	1081.6
1981	245,331,000	821,000	246,152,000	9,956,771,000	62,750,200	10,019,521,200	226,292,000	1087.7
1982	234,306,000	879,000	235,185,000	9,278,984,700	64,630,200	9,343,619,900	230,547,000	1072.2
1983	251,618,000	921,000	252,539,000	9,778,198,700	67,069,500	9,845,258,200	233,662,000	1080.8

unity value, and not to increased tonnages.

Indeed, a fair measure of the insistent inflation of the dollar may be seen in that the average-ton value of folding carton shipments between 1973 and '83 was nearly four times that between '63 and '73. In that earlier decade, the total increase was a moderate $150 per ton. In these latest 10 years, it has been $570.

In any event, this decline in volume for folding cartons, as well as for rigid paper set-up boxes, again illustrates the success of alternate materials and packagings in replacing small paperboard boxes.

For a comparison—the tonnage of board entering into corrugated container production increased 13% in the decade ending 1983, versus the 1.1% for folding cartons. Over the 20 years beginning 1963, corrugated tonnage expanded by 102%, and since '51 by 210%, compared with those respective increases of 12% and 23% for folding cartons.

An even more doleful comparison is per-capita consumption of the cartons and the containers. Twenty years ago, the average U.S. citizen had a 96.5-lb share of the year's corrugated, and 30.8 lb of its cartons. In 1983 his corrugated share was 157.5 lb—up 63% in the double-decade, while his carton share was 27.9 lb—down 9% in a 24% population increase!

Table F-2: The advances of recent years in consumption of highest quality cartonboards reflect the response of box designers to successful challenge by alternate packagings. Solid blached sulfate and clay-coated materials in 1983 held a combined 74% of total production—and the proportion of either was half-again greater than the combined shares of all other board grades together.

On the other hand, some trend is lately appearing toward greater use of the less-costly boxboards. This is in part because of increasing price differential, and in part because the "greater visual appeal" concept has been less than wholly successful in stemming the tide of those alternate packagings.

Hence, during the cheap-material, cheap-energy 1960s decade, the use of clay-coated boards went up 41%, while that of the pedestrian patent-coated dropped 73% and laminated boards went off 42%. In

E-3 — Grades of Corrugated Board Production

Year	Single Face	Double Face	Double and Triple Wall	Total
1953	1,756,000	77,263,100	4,599,000	83,618,100
1963	1,453,600	122,784,800	8,271,700	132,510,100
1973	1,490,000	216,841,400	20,195,800	238,527,200
1974	1,492,200	203,448,600	19,153,800	224,094,600
1975	1,165,500	186,172,400	15,892,300	203,230,200
1976	1,305,200	207,879,800	18,632,700	227,817,700
1977	1,216,500	217,183,800	20,400,600	238,800,900
1978	1,265,000	232,827,000	22,309,000	256,401,000
1979	1,166,000	236,670,000	23,236,000	261,072,000
1980	1,144,000	229,054,000	21,741,000	251,939,000
1981	1,126,000	229,808,000	22,098,000	253,032,000
1982	1,118,000	224,180,000	20,921,000	246,289,000
1983	1,232,000	240,302,000	22,669,000	264,203,000

Source: Fibre Box Assn.

E-4 — Corrugated & Solid Fibreboard Consumption (tons)

Year	Kraft & Jute Liners	.009 Corrugated Materials	Liner & Filler Chip	Total
1953	4,159,100	1,861,100	292,000	6,307,200
1963	6,217,900	2,873,100	182,100	9,273,100
1974	10,621,200	4,746,200	61,400	15,428,800
1975	9,609,100	4,320,200	46,100	13,975,400
1976	10,782,000	4,844,400	50,700	15,677,100
1977	11,318,300	5,102,500	43,300	16,464,100
1978	12,168,400	5,949,700	45,600	17,708,700
1979	12,456,000	5,654,500	9,200	18,159,700
1980	12,018,500	5,427,400	43,600	17,489,500
1981	12,262,400	5,530,400	28,400	17,821,200
1982	11,751,300	5,337,400	29,200	17,117,900
1983	12,594,400	5,767,700	33,600	18,395,700

Source: Fibre Box Assn.

E-5 — Fibre Box Plants, Equipment, Investment, Employees

	1954	1964	1974	1977	1978	1979	1980	1981	1982	1983	1984
Converting Plants	342	463	619	654	654	649	633	621	618	615	612
Sheet Plants	299	504	739	796	795	811	789	772	766	727	713
Total Plants	**641**	**967**	**1,358**	**1,450**	**1,449**	**1,460**	**1,422**	**1,393**	**1,384**	**1,342**	**1,325**
Dbl.-Face Corrugators Operated	404	534	704	755	751	733	722	685	674	665	655
Dbl.-Face Corrugators Total Trim (inches)	30,819	41,432	56,381	61,774	62,811	62,424	62,209	62,175	61,020	60,938	60,608
Pasters Operated	50	34	36	36	36	36	34	33	32	30	28
Pasters Total Trim (inches)	4,243	2,866	2,989	3,005	3,005	3,005	2,857	2,737	2,654	2,488	2,322
Total Companies	**459**	**483**	**784**	**875**	**894**	**884**	**879**	**877**	**853**	**819**	**806**
Est. Investment (MM$)	$327.7	$569.7	$1,128.5	$1,272.5	$1,334.9	$1,426.1	$1,568.7	$1,646.5	$1,615.9	$1,603.6	$1,605.2
No. Employees	48,300	62,400	71,900	65,100	67,300	67,500	63,600	63,100	54,800	59,600	62,300

Source: Plant and machine data from **Official Container Directory**; investment estimated; employment from Fibre Box Assn. A converter must operate complete corrugators or paster to be so classed; one operating only single facers is classed as a sheet plant (one who buys combined board from converters). Companies represent entities ignoring influence of subsidiaries, affiliates or parent relationships, non-operating parent companies not counted.

F-2 — Grades' Share of Folding Boxboard Production (M Tons and % of Total)

Grades	1960		1970		1978		1980		1981		1982		1983	
Solid Bleached Sulfate	728	25.5%	1,144	37.2%	1,236	37.4%	1,236	37.4%	1,180	36.1%	1,128	35.0%	1,146	35.1%
Clay-Coated	734	25.7	1,033	33.6	1,181	35.0	1,179	35.6	1,271	38.8	1,288	40.0	1,276	39.1
Kraft	226	7.9	295	9.6	406	12.0	432	13.0	390	11.9	380	11.8	431	13.2
Bending Chip	326	11.4	231	7.5	198	5.9	156	4.7	164	5.0	149	4.6	160	4.9
Laminated	206	7.2	120	3.9	110	3.3	115	3.5	103	3.2	115	3.6	121	3.7
Bleached Manila	208	7.3	114	3.7	90	2.7	71	2.1	60	1.8	66	2.1	65	2.0
Patent Coated	391	13.7	105	3.4	85	2.5	67	2.0	53	1.6	43	1.3	32	1.0
All Other	26	1.3	33	1.1	42	1.2	55	1.7	56	1.7	50	1.6	33	1.0
Total	**2,856**	**100.0**	**3,075**	**100.0**	**3,375**	**100.0**	**3,311**	**100.0**	**3,274**	**100.0**	**3,219**	**100.0**	**3,264**	**100.0**

Source: Paperboard Packaging Council

F-3 — Folding Carton Plants, Machines & Capacity

	1953	1963	1973	1978	1980	1981	1982	1983	1984
Plants	567	610	706	743	723	711	691	679	673
Companies	434	478	505	527	508	501	485	476	471
No. Platen Cutters & Creasers	1,604	1,371	1,453	1,514	1,521	1,502	1,488	1,474	1,467
No. Cylinder Cutters and Creasers	1,883	1,974	2,332	2,441	2,439	2,440	2,432	2,424	2,419
No. Blankers — Web fed	190	174	294	339	330	319	313	307	302
No. Blankers — Sheet fed	33	89	435	565	608	602	574	556	548
MM sq in./hr Capacity	8,984.3	12,429.6	20,545.4	29,543.0	31,250.8	31,320.6	30,959.9	30,487.1	30,161.6
MM sq in. Capacity/hr/plant	15.85	20.38	29.10	36.76	43.22	44.05	44.80	44.90	45.10
Estimated Number of Employees	40,900	60,120	75,820	80,900	78,100	75,600	74,300	73,400	72,700
Estimated Capital Investment	$144.2	$387.7	$763.2	$996.3	$1029.5	$1047.0	$1263.5	$1315.3	$1319.1

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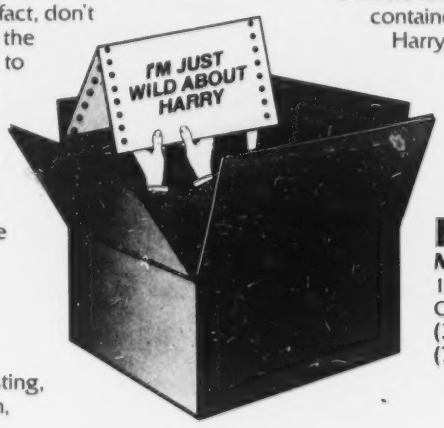

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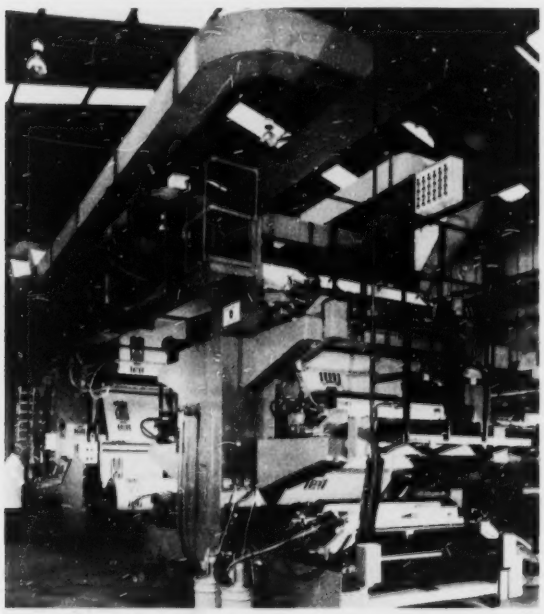

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F-1 — Folding Boxboard Consumed, Shipped, & Shipment Value

Year	Consumed Tons	Index (1967 = 100	Shipped Tons	Dollars (1000)	Average Value/ Ton
1953	2,647,600	85.5	2,250,525	$764,886	$389.87
1963	2,906,000	132.4	2,353,900	959,800	407.75
1973	3,227,000	104.2	2,614,000	1,460,000	558.53
1974	3,160,000	102.0	2,531,721	1,694,960	669.50
1975	2,938,000	94.8	2,380,000	1,755,000	737.29
1976	3,200,000	103.3	2,592,000	1,979,000	763.50
1977	3,258,000	105.2	2,639,000	2,100,000	797.65
1978	3,375,000	108.9	2,734,000	2,278,000	833.21
1979	3,393,000	109.5	2,748,000	2,435,000	886.10
1980	3,311,000	106.9	2,682,000	2,620,000	976.88
1981	3,274,000	105.7	2,652,000	2,866,000	1080.69
1982	3,219,000	103.9	2,607,000	2,952,000	1,132.34
1983	3,264,000	105.4	2,644,000	2,976,000	1,125.57

Source: Paperboard Packaging Council

contrast, consumption of the premium solid bleached sulfate rose 57% in that 10 years. But over the next 10, it was another story.

In 1981, clay-coated board tonnage exceeded that of the solid bleached for the first time in 20 years—and is still doing so. This is scarcely odd. Twenty years ago, the difference in price of solid bleached over clay-coated was $60. By 1973 it was $95. Today it is $175—and the differential with white-patent-coated is $240.

Added board costs of that magnitude must influence box designers strongly, when evaluating the sales advantage of visual appeal in their packages.

Table F-3: The number of producing U.S. folding carton plants decreased in 1983 for the seventh consecutive year, and the number of separate operating companies for the eighth, according to revised listings in our *Official Container Directory*.

U.S. carton plants in 1983 employed some 5400 fewer people than in 1980, and 8200 fewer than in peak '78, because of the continuing shut-down of marginal plants and greater efficiency of automated equipment.

The reduction in number of plants is compensated somewhat by an increase in average converting capacity. At mid-1984 the industry's cutting/creasing capacity—a measure of carton operation size—had reached 45.1 million sq in. per hour per average plant—some 55% higher than a decade ago. During the same 10 years, investment per average plant went up 80%, and the value of its shipments rose 114%.

The average U.S. citizen spent $12.74 for his folding cartons in 1983, up 84% from $6.94 in '73. The average industry employee, including office personnel, represented $40,940 worth of carton shipments, up $110 from $19,520 in 1973.

Composite Cans/ Tubes/Cores

Table G: The progress of these diverse recycled-fibre conversions illustrates that bare-percentage expressions of increase in volume and value may be highly misleading in an assessment or product influence.

In the case of composite cans, for an example, a relatively moderate annual expansion might denote a

G—Composite Can, Tube and Core Commercial Production

Estimates by Composite Can and Tube Institute, Washington, D.C.

year	All Products	Composite Cans	Products other than Cans*
1953	**$160.8**	**$84.6**	**$76.2**
1963	249.0	125.4	123.6
1973	502.2	280.6	221.6
1974	560.4	332.8	227.6
1975	**644.3**	**387.8**	**256.5**
1976	727.5	421.8	305.7
1977	**783.3**	**449.5**	**334.3**
1978	840.4	474.2	366.2
1979	**900.0**	**488.8**	**411.2**
1980	034.1	514.4	419.7
1981	**1021.0**	**555.3**	**465.7**
1982	1017.2	565.0	452.2
1983	**1131.2**	**633.4**	**497.9**

*Includes tubes, cores and miscellaneous specialties.

virtual takeover of the market for a fully worthwhile sector of good-volume product end uses.

For that reason, the 11.2% value rise in 1983 from '82 for the cans and related products would appear to be stunningly below the annual average of a 125% total advance in the decade, and of 353% since 1963, and a startling 604% expansion since '53, though in itself that improvement compares more than favorably with the year's expansion in other areas.

One factor in the moderated expansions of recent years is the nearly complete takeover from metals in such high-volume end uses as the one-quart motor-oil cans, and those for citrus-juice concentrates, which are produced in billions per year.

The composite products "other than cans" include some of the most competently devised functional developments in any materials area. These comprise the cores and tubes, which have provided strength and service superior to steel, at lower cost.

Unfortunately, however, we all are both the beneficiaries, and sometimes the victims, of new developments. One one-quart composite motor-oil can, hard won away from steel, and recently providing a full 36% of this industry sector's output, is under a strong and sturdy attack.

The challenger, almost predictably, is the blown-plastic bottle. As of this 1984 summer, major oil companies are publicizing their shift to the plastic containers. Test marketing of public preference has indicated that any producer who does not replace the composite can may be endangering his market share.

Observing this trend, the largest U.S. producer of composite cans is tooling up for manufacture of plastic alternates. And, because of recent industry concentration through acquisition and merger, the two leading producers have withdrawn from reporting of their volume, to avoid revealing market share. As a result, the venerable Composite Can and Tube Institute has ceased publication of industry statistics, and has gone the way of other beset associations in restricting its business reports to its member companies.

Fibre Drums

Table H: Gains over 1982 in both total of units pro-

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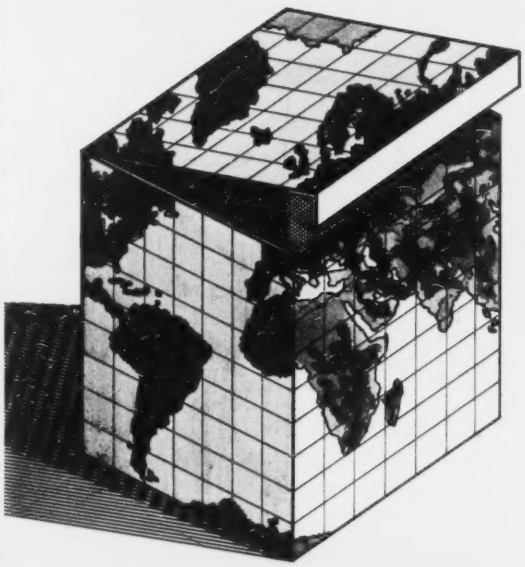

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duced (4%) and value per unit (13.6%) brought the 1983 fibre drum sale value well above $550 million—a gain of 18% over '82 and of 295% in the decade.

Some 70% of this decade's improvement in value has come during its second half—since 1978. Though a good part of this current-dollar rise reflects inflation, the increase in unit production—63% since 1973—indicates that research has been effective in design versatility and new applications. These include a wide acceptance in, for example, the growing field of powdered-metal usages, and in advanced features for the safe transport of inflammables, explosives, toxics, and other hazardous materials.

While precise statistics on fibre drum end uses are not complied by any central industry association, an informed estimate of basic categories is: chemicals 42%; food and related products 17%; plastic resins 16%; pharmaceuticals 7%; detergents and soaps 6%; machine parts, abrasives, metal powders, wire, and stampings 6%; rolled materials such as films 2%; and all other products and materials 4%.

H—Growth of the Drum Industry

Year	Estimated Million Drums	Estimated Average Price Per Drum	Estimated Dollar Equivalent
1953	29.7	$2.04	$60,588,000
1963	32.2	2.30	74,060,000
1973	50.9	2.83	143,915,000
1974	56.8	2.94	167,149,000
1975	46.6	2.96	137,936,000
1976	50.7	3.17	160,719,000
1977	54.6	3.41	186,190,000
1978	59.0	3.83	226,074,000
1979	64.0	4.21	269,440,000
1980	69.4	4.80	333,120,000
1981	72.9	5.33	388,557,000
1982	79.9	6.02	480,998,000
1983	83.1	6.84	568,400,000

I-1—Rigid Box Industry Sales

	(Percentage distribution by end use)		
	1963	1973	1983
Testiles, Apparel & Hosiery	24.59	9.5	3.2
Department Stores & Specialty Shops	15.78	14.4	5.6
Cosmetics & Soap	6.78	4.3	1.4
Confections	12.41	10.0	16.7
Stationary & Office Supplies	5.49	7.6	17.2
Jewelry & Silverware	4.16	8.7	10.1
Photographic products & Supplies	2.39	2.4	4.5
Shoes & Leather	3.00	6.7	0.5
Drugs, Chemicals & Pharmaceuticals	4.77	7.2	6.6
Toys & Games	2.82	2.5	2.9
Hardware & Hosehold Supplies	3.63	4.6	7.6
Food & Beverages	1.48	1.1	1.5
Sporting goods	1.13	1.6	0.5
others & Misc. Customers	11.57	19.4	21.7

I—Annual Dollar Sales

Year	Dollar Sales Year To Year (in millions)	(% Change)
1953	$279.3	—
1963	314.8	+ 12.7
1968	421.8	+ 34.0
1973	485.0	+ 15.0
1974	536.9	+ 10.7
1975	483.2	− 10.0
1976	556.1	+ 15.5
1977	602.3	+ 8.3
1978	653.0	+ 8.4
1979	707.9	+ 8.4
1980	738.3	+ 4.3
1981	787.8	+ 6.7
1982	739.4	− 6.1
1983	814.1	+ 10.1

Rigid Boxes

Tables I-1 & I-2: In 1983, the rigid box (or set-up box)—the oldest of the paper box types—reached its highest dollar sales value in history.

Last year, that industry was reported to be up 10.1% from 1982, up 678% from 1973, and up 159% from 1963.

Thus did the rigid box industry continue to display one of the most resilient marketing performances in packaging history.

Rarely, if ever before, has any packaging form seen 60% of its largest single end use (Textiles, Apparel & Hosiery) lost to competition within a single decade—and 87% within two decades.

Fewer still could not only have survived, but expanded their annual sales value.

The venerable rigid box did precisely that.

That performance is, in fact, one aspect of a massive evolution.

At the "high tide" of around 20 years ago, approximately 800 rigid paper box plants, large and small, were listed in our *Official Container Directory*.

These now have been consolidated into about 360 such facilities, producing boxes of much greater annual value, though consuming much less total paperboard.

The old-time "cottage industry" set-up boxmaker has either closed his operation, or else he has merged it into larger, better-financed units.

At the same time, the great majority of set-up box plants in this country are independently owned and operated. This distinguishes this particular industry from the situation that takes place within the folding carton and corrugated areas. In those latter two, approximately 85% of total conversion is integrated.

The typical rigid box plant can thus offer a degree of "personal service" not to be matched elsewhere in packaging.

The rigid-box producers are armed with a vastly wider arsenal of accessory materials. Among these advantages are the E-flute corrugated, the transparent window inserts, the blown-plastic colored paste-ons, the strong lightweight folding boards—just to name a few.

These innovations have helped greatly in counteracting the rising costs of manufacturing and shipping these low-density box products.

Above all, rigid box producers have been ingenious and aggressive in meeting the demands of new and old markets.

The sequence of end use distribution in Table I-1 was tabulated originally in the order of highest to lowest percentage of industry sales.

It now bears little or no resemblance to that order, as new areas of market opportunity were developed while others declined.

That combination of producer ingenuity and product versatility is reflected in continued success of the set-up box. □